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A review of muskrat *(Ondatra zibethicus)* aging techniques and their application to Oak Hammock Marsh Wildlife Management Area muskrats

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A review of muskrat (Ondatra zibethicus) aging techniques and their application to Oak Hammock Marsh Wildlife Management Area muskrats.

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ABSTRACT

In 1984, the relative ages of 827 muskrats (Ondatra zibethicus) from Oak Hammock Marsh Wildlife Management Area collected during the fall salvage trapping season were determined using pelt primeness patterns. Tooth fluting lengths were measured for 482 of the 532 carcasses collected and examined for relative age distribution and age/sex ratios. All specimens appeared healthy and females had a conception rate of 14.31 juveniles/reproductive female. Pelt primeness analysis produced a ratio of 7.6 juvenile/adult female indicating a 53% loss of juveniles over the summer due to natural causes, assuming the trapped sample approximates the general population age structure. It is recommended that a large number of known age muskrats be tagged for recovery in the future trapping seasons for confirmation of aging classifications.

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INTRODUCTION

The muskrat (Ondatra zibethicus), a major contributor to Manitoba's fur harvest, has long been of concern to wildlife managers in Manitoba (Rewcastle 1984), particularly in attempts to discover reliable methods for monitoring drastic population fluctuations.

A review of established aging techniques was made to determine the method best suited to the prescribed situation. Body weights and measurements are unreliable criteria for relative age determinations of muskrats (Schofield 1955). Zygomatic breadth was used by Alexander (1951) for whom it proved reliable. The drawback of this method was the length of time required for the skulls to dry. Skulls must dry for identical amounts of time and at the same humidity levels because variable shrinking rates bias the results. There is no guarantee of equal time intervals or humidity levels; therefore, this method was rejected.

Several authors (Errington 1939, Baumgartner and Bellrose 1943, Alexander 1951, Schofield 1955) suggest the condition or development of internal genitalia as a reliable aging technique; however, all indicate that this method is consistent only during the non-breeding season and becomes less reliable as breeding approaches. As samples are most easily gathered throughout the province during the spring trapping season which includes the

the onset of breeding, this method was deemed inappropriate.

Penis and baculum dimensions proved to be a reliable technique for Schofield (1955) and Elder and Shanks (1962). It is only applicable to male specimens, however, and is best used to verify results from other methods.

Pelt primeness is an easy, quick and relatively reliable method for aging and sexing muskrats in the fall (Applegate and Predmore 1947, Shanks 1948, Schofield 1955, Elder and Shanks 1962). This method may be used in conjunction with others as a verification procedure for fall caught muskrats.

Several opinions have been expressed regarding the use of tooth wear and fluting lengths as an aging method. Fluting length is the distance from the tooth surface to the end of the ridge at the root end. This is an indication of the amount of wear on the teeth, root development and an indication of the relative amount of time the individual muskrat has lived (Elder and Shanks 1962). This method was chosen because muskrats are short lived, not often surviving more than two years and age groups are morphologically indistinguishable. Conventional pulp cavity widths and cementum annuli methods require special equipment, are expensive to process and are very time consuming (Alexander 1960). Measurements of fluting length is a relatively simple and quick method but has initiated great debate among researchers as to degree of reliability (Elder and Shanks 1962 Westworth 1974). There is also

disagreement over which tooth provides the most reliable results (Sooter 1960, Gould and Kreeger 1948, Sather 1954, Schofield 1955, Olsen 1959, Alexander 1960). Despite these disagreements measurement of fluting length is a method which can be applied to both sexes at all times of the year. The ages determined can be verified using alternative techniques. Relative length categories must be established for each population to be monitored as food supply and quality influences tooth wear and fluting length (Alexander 1960).

METHODS

Muskrat carcasses were collected from trappers active in the Oak Hammock Marsh Wildlife Management Area (Fig. 1) during the fall salvage season, October-November 1984. The carcasses were sexed, internal examinations of females were made to determine the number of placental scars and the penis was removed from males. The head was removed from the body and heated in an enzyme solution (Appendix I) to loosen the teeth. Penises were also prepared in this solution. The right upper and lower first molar were removed where possible. When this failed the left upper and/or lower first molar was substituted. Teeth were examined and each specimen was subjectively placed in the adult or juvenile age class according to Olsen (1959). Fluting lengths were measured on the anterior buccal side to the nearest .05 mm. with dial calipers. A frequency histogram was drawn for these data. The breaking points between

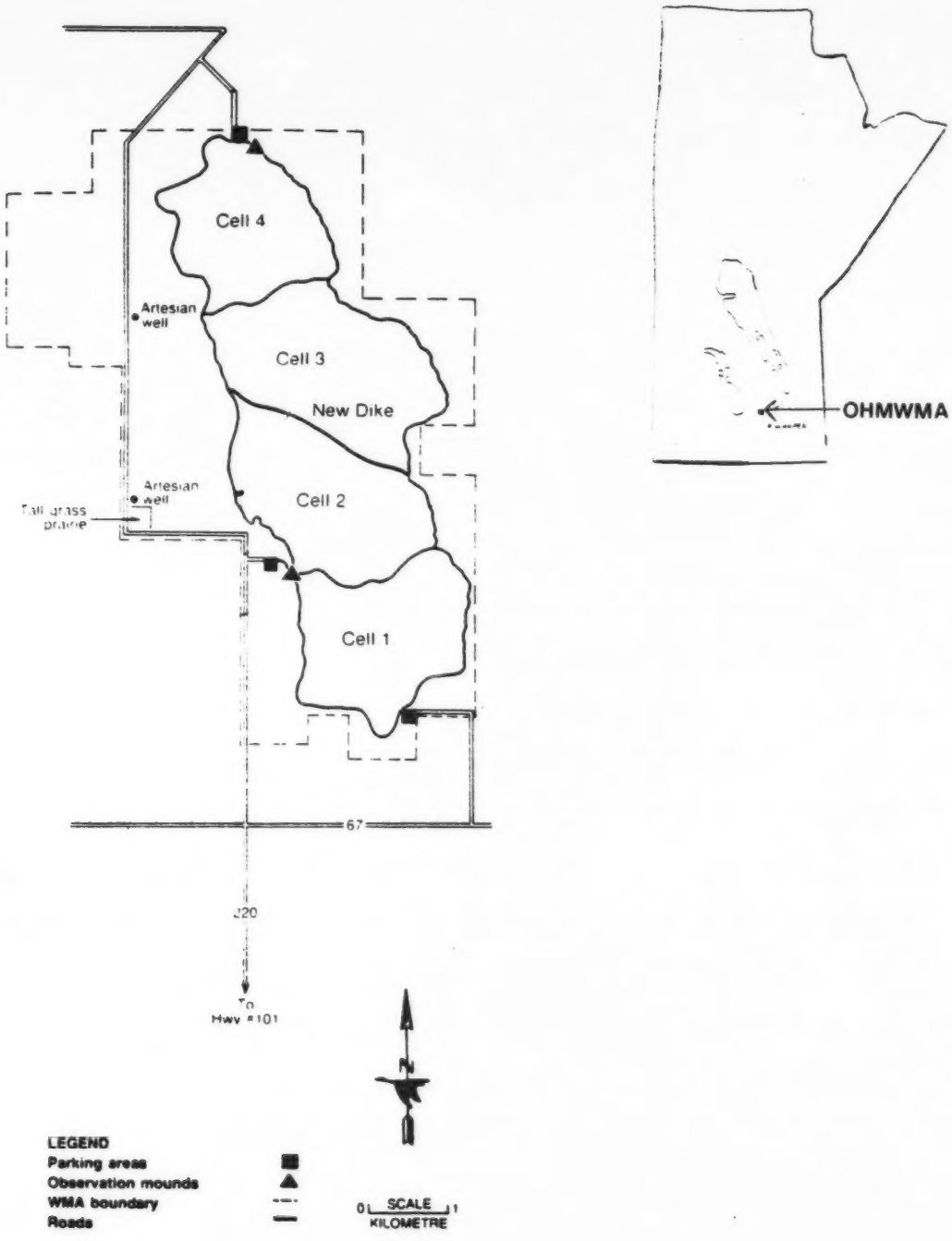

Figure 1: Oak Hammock Marsh Wildlife Management Area.

the modes of the curve were determined subjectively by examining the histograms.

Pelts were examined while in possession of the trappers. The age-sex ratios determined were compared to those calculated using other techniques such as fluting length. The mortality rate of juveniles from conception to the fall trapping season was then calculated.

RESULTS

The pelts of 827 muskrats were sexed and aged as follows:

TABLE 1: Summary of muskrat pelts classified by sex and age group.

	Juveniles			Adults		
	Male	Female	Total	Male	Female	Total
NUMBER:	366	269	635	108	84	192

Juvenile:Adult 3.3
Male:Female 1.3
Juvenile: Adult Female 7.6

The carcasses of 532 muskrats were examined. All appeared very healthy, and most juveniles had attained almost full adult size. Fluting lengths of 482 of the 532 muskrats (as some were broken during extraction) were measured. These ranged from 1.5 mm to 11.04 mm. Frequency distributions were plotted for upper and lower teeth separately (Fig. 2 and 3.). The range for top teeth was 1.54 mm to 10.55 mm and for the bottom 1.50 mm to 11.04 mm. The histograms show distinct separations or groupings although the plot for bottom

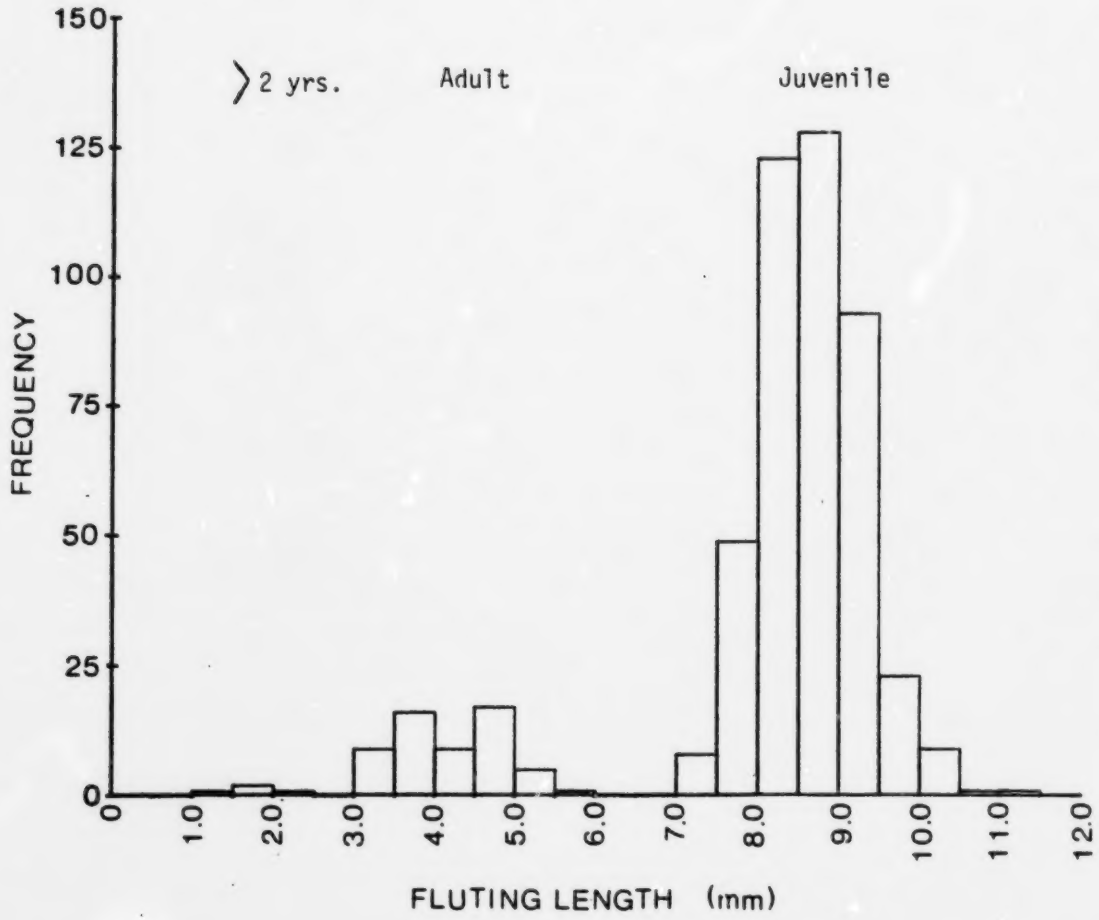

Figure 2: Frequency diagram for top first molar fluting length.

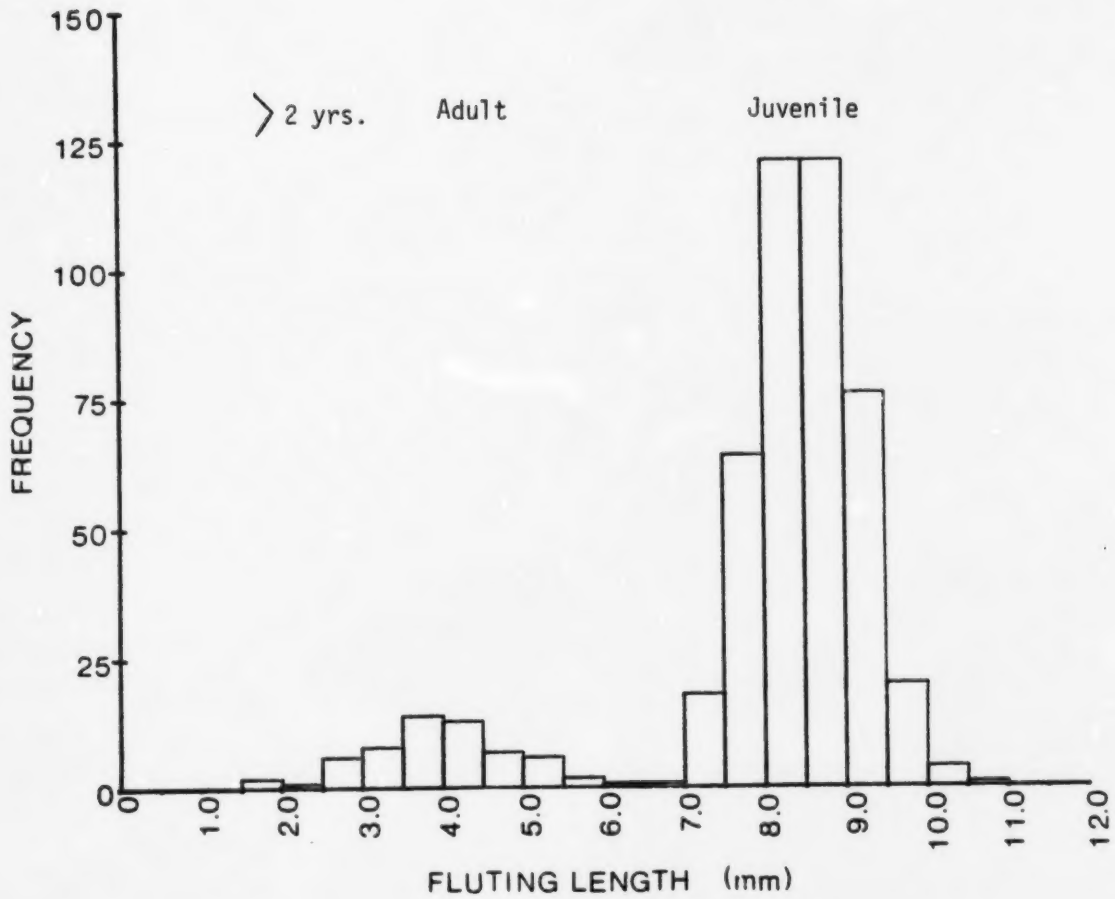

Figure 3: Frequency diagram for bottom first molar fluting length.

teeth showed some overlap. The right grouping represents juveniles, the centre grouping adults and the left grouping was probably adults older than two years. The upper teeth had more distinct separations than the bottom.

Individual muskrats were categorized using the maximum and minimum lengths for each grouping. The results were:

TABLE 2: Summary of muskrat teeth categorized to age group.

	Juvenile			Adult		
	Male	Female	Total	Male	Female	Total
NUMBER:	233	177	410	30	30	60

Juvenile:Adult	6.8
Male:Female	1.3
Juvenile:Adult Female	13.67

A large discrepency was found when comparing results from fluting lengths and pelt primeness. Pelt primeness results indicated a ratio of 3 Juveniles: Adult while tooth measurements produced a ratio of 6.8 Juveniles:Adult.

Tooth analysis and placental scar counts showed that 15.92 juveniles were conceived/pregnant adult female and 4.42 juveniles were conceived/pregnant juvenile female. However, this cannot be confirmed. The range was from one placental scar to 23 scars indicating from one to three litters were produced per reproductive female over the summer (McLeod undated). Pooling the two categories resulted in 14.31 juveniles conceived/reproductive

female. Pelt primeness analysis produced a ratio of 7.6 juveniles/adult female. Thus, 53% of the juveniles were lost due to natural factors over the summer assuming all were born live. Some of the individuals classed as juveniles based on fluting length may actually have been adults (Westworth 1974). There was a discrepency of five and a question on four specimens between subjective aging based on root development and ages determined from the histograms. This represents approximately 1% of the total sample. All of these questionable specimens were subjectively aged as adults by root characteristics but were classified as juveniles by fluting length. Preparation of bacula was unsuccessful as the cartilage used to classify them often dissolved in the enzyme solution making them impossible to use. The preparation of the baculum was very tedious and time consuming; therefore, it is not practical to use unless there is no other method available.

No statistical testing of the fluting length could be accomplished as there were no known age samples for comparison.

DISCUSSION

The excellent body condition, reproductive status and survival of young muskrats at Oak Hammock Marsh indicated prime muskrat habitat. Reproduction and juvenile survival rates compare favourably with other populations in similar situations (Philips 1979). Reproductive juvenile females had a slightly lower conception rate (4.4) per single litter than adult females

(8.0 for two litters and 5.3 for 3 litters). However, there have not been any records to date of juvenile females breeding in the same year as their birth in Manitoba.

Results produced in this study may demonstrate the inadequacies of both methods of aging. Elder and Shanks (1962) found both methods to overestimate the number of juveniles based on a known age sample. The sex/age ratios and data from subsequent sampling periods may facilitate estimates of mortality rates, predictions of population levels and justification for or against specific trapping seasons.

Fall pelt primeness, is a reliable quick and easy method to determine age /sex ratios (Baumgartner and Bellrose 1943) although there are still some discrepencies (Elder and Shanks 1962). Tooth fluting length does not appear to be as reliable but the results cannot be confirmed without known age specimens. Westworth (1974) indicated that some adults showing juvenile tooth fluting characteristics do get included in the juvenile grouping biasing the results. This case may alter the age/sex ratios and production values but the differences may be negligible for management purposes. Using known age specimens it may be possible to calculate error rates, and thus correction factors, to provide more precise results. Bacula may be more useful in determining the age of males if they are prepared in KOH as did Elder and Shanks (1962). Olsen (1959) indicated that frequency and intensity of trapping effort also biases the age composition of samples;

however, in this study equal trapability of all individuals can be assumed since there had been no trapping season in the marsh for two years previous and trapping was never performed with great intensity in any open season (fall 1982; pers. comm. B.K. Whaley, Oak Hammock Marsh Manager).

The question which must be answered to determine the reliability and applicability of the fluting length method is"Is the proportion of misaged individuals significant and can a correction factor be calculated if it is ?". To discover this, known-aged specimens must be included in the sample to verify results and/or allow the calculation of an adjustment factor.

RECOMMENDATION

A large number of muskrats should be live-trapped, marked and released over a spring-summer period and be recovered in subsequent trapping seasons to confirm results from aging methods and determine survival rates. A method of distinction between and a record of adults and juveniles should be made for future reference. An attempt was made in summer of 1985 to live-trap and tag a number of muskrats but it was unsuccessful. The process will likely be attempted again in the future.

It is also recommended that pelt primeness patterns continue to be used to age muskrats, bearing in mind some inaccuracy, until the reliability of the tooth fluting method is determined.

LITERATURE CITED

Alexander, M.M. 1951. The aging of muskrats on the Montezuma National Wildlife Refuge. Jour. Wildl. Manage. 15:175-185.

_____ 1960. Dentition as an aid in understanding age composition of muskrat populations. Jour. Mammal.41:336-342.

Applegate, V.C. and H.E. Predmore Jr. 1947. Age classes and patterns of primeness in a fall collection of muskrat pelts Jour. Wildl. Manage. 11:324-330.

Baumgartner, L.L. and F.C. Bellrose Jr. 1943. Determination of age in muskrats. Jour. Wildl. Manage. 7:77-81.

Elder, W.H. and C.E. Shanks, 1962. Age changes in tooth wear and morphology of the baculum. Jour. Mammal. 43:144-150.

Errington, P.L. 1939. Observations of young muskrats in Iowa. Jour Mammal. 20:465-478.

Gould, H.N. and F.B. Kreeger, 1948. The skull of Lousiana muskrats (Ondatra zibethicus rivicula Shanks)I The skull in advanced age. Jour. Mammal. 29:138-149.

McLeod, J.A. undated. Studies on the biology of the muskrat in Manitoba 1947-1952. Unpublished.

Olsen, P.F. 1959. Dental patterns as age indicators in muskrats. Jour. Wildl. Manage. 23:228-231.

Philips, D.W. 1979. Muskrat population dynamics on a controlled wetland in southern Saskatchewan. Unpublished MSc. Thesis University of Regina.

Rewcastle, C.S. 1984. Harvest of muskrat (Ondatra zibethicus) from Netley-Libau Marsh, Manitoba. MS Report #84-15. Manitoba Natural Resources, Wildlife, Biological Services. Unpublished.

Sather, J.H. 1954. The dentition method of aging muskrats. Chicago Acad. Sci., Nat. Hist. Misc. 130:3pp

Schofield, R.D. 1955. Analysis of muskrat age determination methods and their application in Michigan. Jour. Wildl. Manage. 19:463-466.

Shanks, C.E. 1948. The pelt primeness method of aging muskrats. Amer. Midl. Nat. 39:179-187.

Sooter, C.A. 1960. Muskrats of Tule Lake Refuge, California. Jour. Wildl. Manage. 10:68-70.

Westworth, D.A. 1974. Ecology of the muskrat (Ondatra zibethicus spatulatus) on the Peace-Athabasca Delta. Wood Buffalo National Park. Unpublished MSc. Thesis University of Alberta.

APPENDIX

Skeletal Cleaning Procedure

This method removes muscles and tendons from bones, such that they may be kept indefinitely without decomposition. The enzyme solution used consists of:

½ cup Sunlight soap

½ cup Bioadd

½ tsp. EDTA

¼ tsp. papain,

mixed in per gallon of water required to immerse the skeleton.

Good results can be obtained with a temperature of 55°C, leaving the bones in the solution for approximately 30 hours. An underdone skeleton will require a knife to peel and scrape off the bone. An overdone skeleton is indicated by teeth falling out of the skull and articulating ends falling off the long bones. In the case of numerous skeletons being cleaned at once, cheese cloth may be used to keep the specimens separate. As the solution evaporates it may be necessary to replace some of the water such that the bone does not remain exposed. The finished bones may or may not turn out to be a clean white, depending on the condition of the carcass.